UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
09/761,489	01/16/01	ABDUL-RIDHA	H	99CON103P-DI

MM91/0815

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EXAMINER	
HA, N	
ART UNIT	**PAPER NUMBER**
2831	

DATE MAILED: 08/15/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/761,489	ABDUL-RIDHA ET AL.	
	Examiner	Art Unit	
	Nguyen T Ha	2831	

-- The MAILING DATE of this communication appears on the cover sh et with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 January 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *7-11 and 21-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *7-11 and 21-47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
18) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 7, 10 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Saia et al (5,874,770).

Regarding claims 7, Saia et al discloses a structure comprising a first capacitor electrode (column 2 lines 54-55), a second capacitor electrode (column 2 lines 58-59), a dielectric (column 2 line 56) comprising ceramic tantalum nitride situated said first and second capacitor electrodes (column 8 lines 45-46).

Regarding claims 10&11, the limitations of the structure wherein the dielectric comprising ceramic tantalum nitride is fabricated using a method comprising the steps of utilizing an ionized metal plasma tool for creating a plasma containing tantalum ions, said plasma being sustained by a mixture of gases containing nitrogen; depositing said dielectric comprising ceramic tantalum nitride on the first capacitor electrode wherein a percentage of nitrogen partial flow in the mixture of gases is adjusted so as to cause a nitrogen content in the dielectric comprising ceramic tantalum nitride to be at least 30% and 60% have been consider, however, the presence of process limitations in product claims, which product does not otherwise patentably distinguish over the prior art, cannot impart patntability to the product. In re Stephens 145 USPQ 656 (CCPA 1965).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saia et al (5,874,770) in view of Catala et al (5,170,318).

Regarding claims 8,9 Saia et al discloses all the limitations discussed above with respect to claim 7, except for the first capacitor electrode and second capacitor electrode are made of copper. However, Catala et al teaches the first and second electrodes are made of copper (column 6 lines 60-61). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Saia et al capacitor as taught by Catala to have the first and second electrodes are made of copper because copper has low adhesion to tantalum nitride, therefore the invention

used the copper for the electrodes in order to improve the conductivity for the capacitors.

3. Claims 21-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over DeBoer et al (6,146,959) in view of Jain (5,821,168).

Regarding claim 21, DeBoer et al discloses structure shown in figure 5 comprising a first capacitor electrode (12) comprising a bottom copper interconnect metal segment a first barrier layer (16) over said bottom copper interconnect metal segment a tantalum oxide layer (38) figure (6) over said first barrier layer; a dielectric (18) comprising tantalum nitride over said copper seed layer a second barrier layer (20) over said dielectric a second capacitor (22) electrode comprising a top copper interconnect metal segment. DeBoer et al lacks the seed layer. However, Jain teaches the copper seed layer (column 4 line 14). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify DeBoer et al capacitor as taught by Jain to have a copper seed layer over the first barrier layer in order to increase the electrode conductivity for the capacitors.

Regarding claims 22, 31-33 the limitations of the structure being fabricated in a single ionized metal plasma tool have been considered, however the presence of process limitations in product claims, which product does not otherwise patentably distinguish over the prior art, cannot impart patntability to the product. In re Stephens 145 USPQ 656 (CCPA 1965).

Regarding claim 23 the limitations of the structure wherein said first capacitor electrode, said first barrier layer, said copper seed layer, said dielectric, said second

barrier layer, and said second capacitor electrode are fabricated in a single ionized metal plasma tool have been considered, however the presence of process limitations in product claims, which product does not otherwise patentably distinguish over the prior art, cannot impart patntability to the product. In re Stephens 145 USPQ 656 (CCPA 1965).

Regarding claims 24&25, DeBoer et al discloses the structure wherein said first barrier layer (38) and second barrier layer (40) comprises metallic tantalum nitride (column 1 lines 6-11).

Regarding claims 26&27, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 21, except for the first barrier layer and second barrier layer comprises metallic tantalum nitride having nitrogen content of approximately 21%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the first barrier layer and second barrier layer comprises metallic tantalum nitride having a nitrogen content of approximately 21%, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 28, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 21, except for the dielectric comprises tantalum nitride having a nitrogen content of at least 30%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the dielectric comprises tantalum nitride having a nitrogen content of at least 30%, since it has been held that where the general conditions of a claim are disclosed in the prior art,

discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 29, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 21, except for the dielectric comprises tantalum nitride having a nitrogen content of approximately 60%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the dielectric comprises tantalum nitride having a nitrogen content of approximately 60%, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 30, DeBoer et al discloses the structure wherein said dielectric comprises ceramic tantalum nitride (column 6 lines 7-15).

Regarding claim 34, DeBoer et al discloses structure shown in figure 5 comprising a first capacitor electrode (12) comprising a bottom interconnect metal segment, a first barrier layer (16) over said bottom copper interconnect metal segment, a tantalum oxide layer (38) figure (6) over said first barrier layer; a dielectric (18) comprising tantalum nitride over said copper seed layer, a second barrier layer (20) over said dielectric a second capacitor (22) electrode comprising a top interconnect metal segment are fabricated in a single tool. DeBoer et al lacks the seed layer. However, Jain teaches the copper seed layer (column 4 line 14). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify DeBoer et al capacitor as taught by Jain to have a copper seed layer over the first barrier layer in order to increase the electrode conductivity for the capacitors.

Regarding claims 35,45-47 the limitations of the fabricated in a single tool being a single ionized metal plasma tool have been considered, however the presence of process limitations in product claims, which product does not otherwise patentably distinguish over the prior art, cannot impart patntability to the product. In re Stephens 145 USPQ 656 (CCPA 1965).

Regarding claims 36&37, the teaching of Jain includes the structure wherein said bottom interconnect metal segment and top interconnect metal segment are comprises copper (column 8 lines 32-35).

Regarding claims 38&39, DeBoer et al discloses the structure wherein said first barrier layer (38) and second barrier layer (40) comprises metallic tantalum nitride (column 1 lines 6-11).

Regarding claims 40&41, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 34, except for the first barrier layer and second barrier layer comprises metallic tantalum nitride having nitrogen content of approximately 21%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the first barrier layer and second barrier layer comprises metallic tantalum nitride having a nitrogen content of approximately 21%, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 42, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 21, except for the dielectric comprises tantalum nitride

having a nitrogen content of at least 30%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the dielectric comprises tantalum nitride having a nitrogen content of at least 30%, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claim 43, DeBoer et al and Jain discloses all the limitations discussed above with respect to claim 21, except for the dielectric comprises tantalum nitride having a nitrogen content of approximately 60%. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the dielectric comprises tantalum nitride having a nitrogen content of approximately 60%, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 44, DeBoer et al discloses the structure wherein said dielectric comprises ceramic tantalum nitride (column 6 lines 7-15).

Citation of Relevant Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Lee discloses the integrated circuit capacitor having recessed oxidation barrier spacers.

b. Li et al discloses a method to form copper.

c. Kirlin discloses a ferroelectrics capacitor and integrated circuit device.

d. Saia et al (5,973,908) discloses a structure for thin film capacitor.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nguyen T Ha whose telephone number is 703-308-6023. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dean Reichard can be reached on 703-308-3682. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3432 for regular communications and 703-305-3431 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

NH
August 12, 2001

Dean A. Reichard 8/13/01
Dean A. Reichard
Primary Examiner